LUCRĂRI ŞTIINŢIFICE SERIA HORTICULTURĂ, 60 (2) / 2017, USAMV IAŞI

THE IMPORTANCE OF THE PRODUCTION OF GRAFTED TOMATO SEEDLINGS

IMPORTANŢA PRODUCERII RĂSADURILOR ALTOITE DE TOMATE

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Abstract. *Grafting tomatoes is considered one of the most important innovations over the last few years. Modernization of plants variety and parent stock is essential, because it brings us closer to the market needs and sustainable agriculture. The aim of the realized experience was to evaluate phenological phases of tomato plants, the productivity and the quality of the fruit under the grafting method (Beril F1, Abelus F1, Lilos F1 and Maxifort F1 rootstocks, Big Power F1). In this experience were assessed the following characteristics of the phytometric indices: the number of leaves, the diameter of the stem, the height of the plant up to the first bunch, in terms of fruit productivity and quality, or the harvest kg / plant, harvest m^2/kg, standard fruit per plot, nonstandard fruit rate (%), cracked fruit rate (%).*
Key words: scion, rootstock, grafting, yield, graft vigor

Rezumat. *Altoirea tomatelor este considerată una dintre cele mai importante inovaţii din ultimii ani. Inovaţia soiului şi portaltoiului este foarte importantă, ne aduce mai aproape de nevoile pieţii şi agriculturii durabile. Obiectivul acestei lucrări a fost evaluarea fazelor fenologice a plantelor de tomate, productivitatea şi calitatea fructelor în funcţie de metoda de altoire (altoi Beril F1, Abellus F1, Lilos F1 şi portaltoii Maxifort F1, Big Power F1). Au fost evaluate următoarele caracteristici ai indicilor fitometrici: numărul de frunze, diametrul tulpinii, înălţimea plantei până la prima ciorchină, din punct de vedere a productivităţii şi calităţii fructelor s-au urmărit recolta kg/plantă, recolta m^2/kg, precum şi indicii numărul mediu de fructe standard pe parcelă, rata fructelor nestandard (%), rata fructelor crăpate (%).*
Cuvinte cheie: altoi, altoire, hibrizi, portaltoi, randament

INTRODUCTION

Due to the considerable global concern about the state of the *environment*, the issue of the development of sustainable agriculture is raised in increasing frequency. It presents model solutions for present and future agricultural practice, capitalizing different categories of agricultural land that guarantee food security and environmental protection.

Because of the rapid evolution of technical, economic and regulatory problems in the field of sustainable agriculture, modern horticulture is highly focused on rootstocks. Among the main factors justifying the use of tomato grafting technology is the reduction of the use of chemical substances for soil

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disinfection, and the need to limit the growing pressure of biotic and abiotic factors on the soil. Grafting technology has opened up prospects for a higher production of safer and more qualitative tomatoes.

Tomato grafting is considered one of the most important innovations in recent years. The innovation of sorts and rootstocks is very important, and brings us closer to the needs of the market and sustainable agriculture. Everything must be integrated into a supply chain concept in order to provide practical help to farmers who have to face the environmental challenges of the future till 2020 (Abdelmageed and Gruda, 2009).

One of the most popular organic summer vegetable crops in hothouses is tomato. If in winter, the demand for tomatoes is mostly covered by the producers in Mediterranean countries, during summer, this vegetable can also be profitable in Central European countries in the conditions of adequate production technology. Organic tomatoes must satisfy consumers through their high quality and good taste, and thus to justify the higher price compared to the common produce.

"The world population is growing and the demand for food increases. There were 7 billion people in 2011, and in 2050 there will be 9 billion people, which means that, if in 2011 each hectare was used to feed more than 4 people, in 2050 the same surface will be used to feed more than 6 people. For this reason, we need more efficiency. Technology can help us. One element that contributes to the increase of the economic efficiency of land is the rootstock" (Abdelmageed and Gruda, 2009).

Today the world market needs strong and stable crops during a stress period. Grafting can help to achieve this object, because it tends to improve the quality of fruit, increases their resistance to biotic and abiotic stress, and their flowering ability. It also ensures a better balance of the plant. A rootstock is like an engine which knows that it is necessary to use the substances in the soil. But we have to rely on objective measurements, which provide for better planning and evaluation.

When developing grafting technologies, a special emphasis has been placed on the compatibility with rustic lines that have a well developed root system able to explore deeper layers of soil.

Grafting is a technique that combines two plants or parts of plants in order to make them grow together. This will allow us to combine plants that are strong and disease-resistant with those that are able to produce good fruit and beautiful flowers (Bogdan, 2012; Gavriț and Ghidaspov; Lorenzo, 2015; Morra *et al.,* 1997; Roşca V., 2009; Savvas *et al.,* 2011; Schwarz *et al.,* 2013; Sanchez *et al.,* 2012; Verevkina).

MATERIAL AND METHOD

According to the objectives pursued in the research which deals with tomato grafting, some experiments were performed to study the growth and productivity of tomatoes in protected areas according to the grafting method and the combination a

scion and a rootstock. The study subject was based on the analysis of the importance of the production of grafted seedlings. Three tomato hybrids have been chosen – Abellus F_1, Beril F_1 and Lillos F_1 – registered for greenhouse cultivation, which had to be used as scions, and two hybrids – Maxifort F_1 and Big Power F_1 – recommend as rootstocks.

BigPower RZ F1 is intended for the cultivation of tomatoes that promote a uniform fructification. It is suitable for tomatoes with undetermined growth as well as determined growth. Due to its good vegetative / productive balance, it leads to superior quality fructification without changing the gloss and color of the fruit. It is salinity resistant and can be used throughout the year.

Maxifort F 1 is a rootstock intended primarily for substrate crops, which imparts a great deal of force to scions. It provides a balance of growth that leads to high yields even to vegetative grafted plants.

The most suitable method of grafting was studied in association with the affinity between the scion and the rootstock, establishing the most suitable combination for the production of tomatoes in protected areas, and determining the productivity and quality according to the combination a rootstock and a scion.

The experiments were carried out at the company "Ecoplantera" Ltd. which specializes in the production of flower and vegetable seedlings, in the year 2012. The sowing was made on 25 February of that year in pallets 216 cells each. The seeds of Abellus F_1, Beril F_1 and Lillos F_1 tomato hybrids were dredged and planted on the same day as the MaxifortF1 and BigPowerF1 rootstocks. The grafting was performed by copulation and splitting after thirty days after sowing, when the plants reached the stage of two true leaves and the diameter of the collar was of 2.5 mm.

RESULTS AND DISCUSSIONS

Vegetable grafting is done with the aim of increasing production and improving the quality of the prevention and control of diseases and pests. It is also an ideal solution to get production at least 25 % higher than untreated plants (control plants).

Similar results of grafting influence on plant development have been obtained during other studies on tomatoes (Savvas *et al.,* 2011).

According to the authors Perry (1982) and Lee (1994), climatic conditions, including light, temperature and rootstock, can have an influence on the yield and chemical composition as well as on the quality of fruit.

In this paper, the results indicate that a higher overall yield was obtained in the grafted plants as compared to the control plants. The fructification capacity was statistically significantly different from the grafted plants.

The examination of the grafting effects on tomato quality and production capacity was carried out during the year 2012, taking two factors as the basis (tab.1.):

1. the growth, development and productivity of tomatoes in protected areas **according to the grafting method**;
2. the growth, development of the productivity of tomatoes in protected areas **according to the combination a scion and a rootstock**.

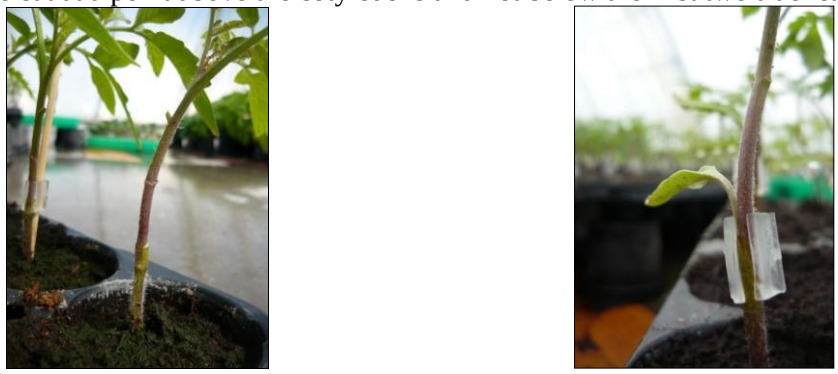
Table 1

The phenological phases of tomato plants according to the grafting method, 2012 (Beril F1 scion; Maxfort rootstock), days after sowing

Variant	Date of sowing	Mass sprout	Appearance of the first true leaf	The beginning of the bloom in the first breed	The beginning of the rebirth	The last harvest
Ungrafted plants (control)	25.02.12	7	13	63	116	16.11
Grafted by splitting	25.02.12	5	11	66	116	16.11
Grafted by copulation	25.02.12	5	11	66	116	16.11

Both the rootstock and the scion were sown on the same day in order for the diameter of the stems to be of the same size at the time of grafting. The index of the appearance of the first true leaf revealed a few days less in the rootstock plants, which was influenced by the biological particularities of the rootstock, which showed a higher growth force compared to the vigor of the scion.

The optimal grafting phenotype is when the plants have from two to four leaflets and are of equal diameter. If the diameters can't be grown to have the same size, then only the diameter of the rootstock seedling is allowed to have a larger diameter than the scion seedling, and not vice versa. The rootstock seedling will be cut at a point above the cotyledons and not below the first two true leaves.



a b

Fig.1 Grafting through the method of: a) splitting; b) copulation at an angle of 45°.

Using the results of the performed researches, the productivity of tomatoes can be analyzed depending on the method of grafting and compared with the control plants (fig.1.).

Table 2

Tomato productivity according to grafting method, 2012 (Beril F1 scion, Maxfort rootstock), kg/m²

Variant	harvest, kg/plant	harvest per m^2 /kg
Ungrafted plants (control)	8.400	21.0
Grafted bysplitting	12.960	32.4
Grafted by copulation	13.248	33.12

Based on the date on tomato productivity according to the grafting method, the results differed significantly from the plants in the control group. When the splitting grafting was used, the plant productivity was 35.2 % higher (32.3 kg/m²) than in the control group. When the grafting method by copulation was used, the grafted plants exceeded the plants in the control group by 36.6 % (tab.2).

The obtained results showed that grafting can greatly increase plant production. The grafting method does not influence productivity.

The grafting effect increased the rate of the standard fruit yield. The grafiting also influenced the weight of the fruit and the vigor of the plant (fig.2.).

Phytometric indices of tomato plants according to the combination scion and a rootstock, 2012 (Beril F1, Abellus F1 and Lilos F1 scions; Maxifort F1 and Big PowerF1 rootstocks), after 90 days after planting

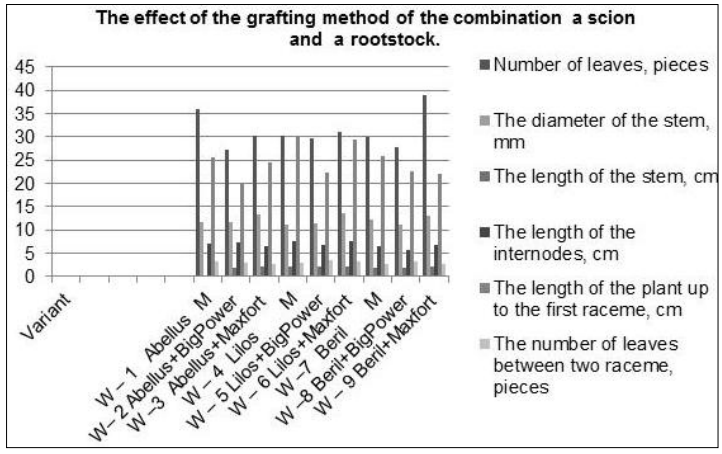


Fig.2 The effect of the grafting method of the combination a scion and a rootstock

When the phytometric indices of tomato plants were measured according to the scion and rootstock combination, differences in biometric indices were observed during the growth period. That happened because they had been positively influenced by the vigorous growth of the rootstock which was able to explore the deeper layers of the soil and fed the plant efficiently because it keeps water and absorbs the soil elements better than the proper root of the plant. Grafted plants have a higher force, which leads to increased production. Grafting

helps to get rid of particularly dangerous diseases and pests such as nematode, which damages tomato crops.

Grated tomatoes have a higher force, a higher production and better fruit quality. Due to its high resistance to diseases and pests, the environment is more protected from chemical treatments. Respectively, the production is environmentally friendly, and it is not very affected.

CONCLUSIONS

In order to specify the results obtained in the experiments, the influence of the biological particularities of the Maxifort F1 and Bif Power F1 rootstocks must to be highlighted, which have shown a higher growth and developmental force on the grafted tomato plants, that have resulted in qualitative and quantitative production increases.

As a result of the study and analysis of the biometric indices of the aerial part of the plant, it was concluded that the most optimal results are in grafted variants.

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